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IMPLEMENTING GRAPHIC ORGANIZERS IN A GENERAL  
EDUCATION EARTH SYSTEMS CLASSROOM

by

Jennifer Slade

A thesis submitted in partial fulfillment  
of the requirements for the degree

of

MASTER OF SCIENCE

in

Special Education

Approved:

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UTAH STATE UNIVERSITY  
Logan, Utah

2009

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## ABSTRACT

Implementing Graphic Organizers in a General  
Education Earth Systems Classroom

by

Jennifer Slade, Master of Science

Utah State University, 2009

Major Professor: Dr. Ben Lignugaris/Kraft  
Department: Special Education and Rehabilitation

Previous research has shown that implementing graphic organizers and giving the needed instruction to use and study content information increases academic gain of students with learning disabilities. In the present study students actively engaged in using graphic organizers, which helped them demonstrate their learning on multiple choice questions. On the multiple choice test, the overall mean gain for the experimental group was 45%. The control group's overall mean gain on the multiple choice test was 30%. While the posttest scores for students in the graphic organizer group were significantly higher than posttest scores of students in the control group, few students mastered the material. On a short answer test in which students answered definition, compare and contrast questions, students in traditional instruction outperformed students who received graphic organizer instruction. On the short answer test the mean gain for the experimental group across question types was 17% and the mean gain for the control group was 21%. These results are discussed relative to the available research on graphic organizers.

(64 pages)

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## INTRODUCTION

Historically, students with learning disabilities struggle with acquiring the needed skills and knowledge to successfully complete their public education. According to the National Center for Learning Disabilities (National Joint Committee on Learning Disabilities, 2005) the majority of students with learning disabilities have difficulties in the area of reading, a skill that is necessary to complete the high school competency test. Specifically, NCLD states that two-thirds of secondary students with learning disabilities are three or more grade levels behind their peers. More than 27% of students with learning disabilities drop out of high school. Two-thirds of high school graduates with learning disabilities were rated "not qualified" to enter a 4-year college. Only 13% of students with disabilities have attended a four-year, post secondary school program within 2 years of graduating. Staying in high school is a difficult task for students with learning disabilities. The No Child Left Behind (NCLB) legislation has made graduating from high school increasingly difficult. Previously, students graduated from high school based on their grades and courses completed. Now, "all" students are required to pass a high school competency test in order to graduate (National Joint Committee on Learning Disabilities, 2005). Not only are students with learning disabilities required to pass an end-of-level test, but the trend has resulted in their increased participation in general education classes (Erickson, Ysselydke, Thurlow, & Elliot, 1998). The current expectation is that all students must have access to the general curriculum, and not merely acquire independence, but apply high level thinking skills in content area problem solving activities (Deshler et al., 2001). NCLB has also encouraged teachers and educators to analyze classroom practices and their students' success. Although NCLB is



not perfect, it has made teachers become more accountable for all students who are in their classrooms. Thus, NCLB legislation has caused educators to investigate more collaboration between regular education and special education. NCLB and IDEA both state that all students must participate in assessments and must receive instruction by highly qualified teachers. In order for students with learning disabilities to pass the high school competency-based test (the UBSCT in Utah), educators must implement research-based best practices in content area classes such as math, science, and social studies.

Due to the number of students with disabilities dropping out of high school, the Office of Special Programs (OSEP) conducted a nationwide consumer survey in 2000 for IDEA Nation Program Planning (Baker, Gersten, & Scanlon, 2002). Over 14,000 individuals with disabilities, parents, service providers, administrators and policy-makers responded to the survey. The survey asked them to identify five areas they believed had the highest impact on improving the lives of students with disabilities. Fifty-one percent of respondents concurred that having better access to the curriculum would have the most impact.

In a related activity, Baker et al. (2002) conducted focus groups that studied ways to help students transfer materials learned in school to day-to-day tasks. The panels' main focus was, "to articulate issues and unresolved tensions in the concept of access to the general education curriculum" (Baker et al., p. 65). The panel concluded that a better definition of curriculum access was not just about the students with disabilities being allowed to take challenging classes, but about students with disabilities having a real opportunity to successfully learn challenging content.

The most important piece of the focus group's discussion was the lack of research regarding how to best teach students with learning disabilities in regular content classrooms. The focus group determined that more research needs to be done in this area. It was also noted that previous research was underutilized by regular education and special education teachers when teaching content to students with disabilities. The focus group refined that concept to include meaningful participation and adequate progress. Based on the findings of OSEP, the focus group's recommendation was the use of content enhancements in secondary education.

The purpose of content enhancements is to prepare secondary special education students for regular education. There has been a significant amount of research done over the last two decades regarding content enhancements (Baker et al., 2002). In a classroom using content enhanced principles, Bulgren (2006) stated:

The teacher acts as a mediator of instruction, builds on students prior knowledge, selects the most important content information, and organizes and transforms that information so that all students can succeed. Content enhancements include collaboratively developed graphic devices which help students understand and generalize information. It also incorporates underlying strategic approaches to targeted content learning needs. Content enhancements respond to teachers' recommendation for using a variety of teaching methods and modifying curriculum and the need for higher-order thinking scaffolds. (p. 55)

One type of content enhancement is a graphic organizer. Graphic organizers provide comprehensible input, and are imperative for students with learning disabilities.

Students with learning disabilities often do not comprehend the task at hand and therefore, do not even attempt the task. A graphic organizer is a tool for organizing and understanding content information (Baxendell, 2003; Dye, 2000; Kim, Vaughn, Wanzek, & Wei, 2004). Graphic organizers provide an approach that is different from traditional linear text presentation. They provide the structure of the whole text and the interrelations between concepts that are presented in a visual method that gives the reader a clear and explicit understanding of the critical content (Chang, Sung, & Chen, 2002).

Advance organizers help learners see the relationships among key concepts, terms, concept illustrations, and details (Robinson, 1998). Grossen (1991) has suggested that graphic organizers help students construct meaning. They concretely represent abstract or implicit information and show relationships. They also help to organize ideas, help to relate new information with prior knowledge, and assist in the storage and retrieval of information (Grossen).

Adolescent students with learning disabilities face problems when trying to succeed in the general curriculum because their disabilities are often related to organizing content information, differentiating major ideas from supporting information, comparing and/or contrasting information, reading and understanding large amounts of content information, relating one's background knowledge to a new set of information, holding large quantities of information in memory, and expressing information on tests and in papers (Deshler et al., 2001). For students with learning disabilities to be successful, content enhancements are needed. Content enhancements provide students with learning disabilities the skills to think and act "strategically" which carries on through post secondary education. According to multiple researchers (e.g., Boudah, Lenz, Bulgren,

Schumaker, & Deshler, 2000; Bulgren, Lenz, Schumaker, Deshler, & Marquis, 2002; Deshler et al., 2001; DiCecco & Gleason, 2002; Kim et al., 2004; Lenz, Marrs, Schumaker, & Deshler, 1993), thousands of students with learning disabilities have been successfully learning with content enhancements and becoming independent learners.

## PURPOSE OF STUDY

The purpose of this study was to investigate the effect of a content enhancement, such as graphic organizers, on the academic performance of students with learning disabilities attending a regular ninth grade Earth Systems class. The following research questions were addressed:

1. To what extent does a graphic organizer, guided instruction, and discussion in a ninth-grade Earth Systems class result in a difference in the percentage of correct responses to multiple choice and short answer Earth Systems questions as compared to students in the Earth Systems class who use traditional outline/notes, guided instruction, and discussion?
2. To what extent do students with learning disabilities and English Language Learners who are provided a graphic organizer, guided instruction, and discussion in a ninth-grade Earth Systems class produce a higher percentage of correct responses to multiple choice and short answer Earth Systems questions than students with learning disabilities and English Language Learners in a Earth Systems class who use traditional outline/notes, guided instruction, and discussion?

## REVIEW OF LITERATURE

There have been multiple studies conducted on the use of graphic organizers in content classrooms over the past 15 years. The journal articles and research studies that were reviewed for this study were located through searches of ERIC files and other library searches of data bases such as The Journal of Special Education, The Journal of Experimental Education, The Journal of Educational Research, Journal of Learning Disabilities, Teaching Exceptional Children, and psychology journals as well as through multiple educational publications. The terms used to find articles that would meet the criteria for this study were content enhancement, graphic organizers, secondary, students with learning disabilities, and content areas such as science/biology, inclusion, scaffolding, middle school and junior high. There were many research articles found in this search. The articles reviewed were chosen if the study focused on using of graphic organizers after reading expository text to organize and understand information, and if the study was implemented in a secondary content area regular education classroom with students with learning disabilities. Four of the studies reviewed met these criteria and are reviewed below. One group of researchers implemented the content enhancer of a unit organizer routine that addressed the whole unit. The other researchers use a graphic organizer that addresses a chapter at a time.

In one study, Lenz et al. (1993) used a content enhancement which they called a unit organizer routine. The research was conducted across three high schools and three middle school general education classrooms that included students with learning disabilities. The researchers collected data through the use of single-subject, multiple baseline designs on two high achieving students (grade point average of 3.6-4.0), two

average achieving students (grade point average of 3.2-3.6), two low achieving students (grade point average below 3.2) and two students with learning disabilities. The study was conducted over a seven-month period. The organizer consisted of two pages. The first page consisted of an overall organization for the unit information, relationships, questions and tasks. The second page provided ongoing structures for effective note taking. The students were introduced to the Unit organizer at the beginning of the unit with the students and teacher completing the first page together. As the students and teacher moved through the unit, they completed page two by adding and connecting relevant and important details that supported the key information on page one. The unit organizer routine is teacher directed and can be used with an expository text or with a lecture format.

The researchers demonstrated that this unit organizer routine, increased teacher planning and enhanced the performance of students with learning disabilities, low achieving students, and average achieving students. The students improved their understanding and retention of information. In the classes that used the unit routine organizers on a regular basis the students consistently scored 15 percentage points higher on unit tests than those students whose teacher used the unit routine organizer irregularly. It was also found that the unit routine organizer was effective for high achieving students when the content became more difficult or abstract.

Bulgren et al. (2002) used a concept comparison routine in a general content class to enhance students' understanding of conceptual information and similarities and differences between the concepts. The Concept Comparison Routine included three phases. The first phase was called the "Cue Phase." The students were cued about the

importance of the information they were to learn. They were instructed to take notes through the teachers helping them understand the use of a Concept Comparison Routine. The purpose of the phase was to get the students ready to use the Concept Comparison Table.

The second phase was called the “Do Phase.” In this phase the students construct the Concept Comparison Table with guidance from the teacher. The Concept Comparison Table includes the following: (a) naming the items of conceptual information to be compared, (b) naming the overall concept category into which the conceptual items to be compared fit, (c) examining characteristics of each item, (d) identifying the characteristics that are alike, (e) identifying the categories associated with the like characteristics, (f) identifying the characteristics that are different, (g) identifying the categories associated with the different categories, (h) writing the summary statement, and (i) responding to a challenge that requires extending the students’ understanding of the conceptual information into new areas.

The final phase is called the Review Phase. In this phase the students review the information on the table. The teacher checks for student understanding of the information and facilitates a discussion that involves analyzing conceptual information and making meaningful comparisons. This phase ensures that students can speak about the information and explain the cognitive process involved in analyzing any concept and how that cognitive process can be applied in other comparison tasks.

The participants included 107 students that were enrolled in 7<sup>th</sup>, 8<sup>th</sup>, 10<sup>th</sup>, 11<sup>th</sup>, and 12<sup>th</sup> grade science classes. The study included several sub groups including the HA (high achieving), NA (normal achieving), LA (low achieving), and LD (learning disabilities).



The HA group had a grade point average of 3.5 to 4.0. The NA group had a GPA below 3.5. The LA group had received at least two grade levels below a C during the previous semester. The LD group qualified as learning disabled by following the district and state guidelines. The control group consisted of 9 HA, 16 NA, 10 LA, and 17 LD students. The experimental group consisted of 12 HA, 17 NA, 6 LA, and 20 LD students.

The topic of tropical diseases was picked as the concept. The two diseases to be compared were malaria and snail fever. A script was developed to provide both the experimental group and the control group identical instruction. The scripts differed only during the Concept Comparison Routine instruction for the experimental group and traditional lecture-discussion format for the control group.

A test was designed to access both recall of information as well as recognition of information. The recall portion asked students in the experimental group to recall information from the Concept Comparison table and the control group to recall information from traditional note taking. The recall test was removed before the second part of the test was given. The second part of the test included questions to measure students' recognition of characteristics associated with the comparison of snail fever and malaria. There was a total of 110 points possible on the test. The result of the study showed the LD control group scoring a mean percentage score of 50.68 and the LD experimental group scored a mean percentage of 71.2. The LA group also showed a difference with the control group scoring a mean percentage of 62.64 and the experimental group scoring a mean percentage of 86.6. The NA group showed more growth as well with the control group scoring a mean percentage of 76.02 and the experimental group scoring a mean percentage of 83.48. Even the HA group showed a

small difference between the two groups. The control group scored a mean percentage of 84.14 and the experimental group scored 86.53. The research clearly showed that students using the graphic device of a Concept Comparison Routine improved learning and test scores.

In another study, Doyle (1999) compared traditional lecture and note taking to the use of graphic organizers in a high school social studies classroom. In the study, chapters from the text were taught using graphic organizers as a teaching method and study tool. Two chapters were taught with traditional lecture and note taking. The participants included eight high school students with learning disabilities, two students were white males, three students African American males, and three students were African American females. The students had grade equivalence reading levels ranging from 2.4 to 10.2 according to the Weschler Individual Achievement Test. All students participated in both conditions. Two chapters were taught with graphic organizers and two with traditional lecture and note taking.

During the lecture and note taking condition, the teacher wrote notes on the board and the students were instructed to write the notes down. The teacher implemented supplemental materials at times during the lecture. The students also answered the questions in their textbooks. The students used notes taken during lecture for studying for the end of chapter test.

During the graphic organizer condition, three organizers were implemented. The first organizer was a problem and solution type. The students read the text, discussed the information, and then completed the graphic organizer as a group. The second organizer was a diagram with the main idea and supporting details of the three important concepts.

After reading the text the students worked in pairs to complete the graphic organizers. After reading the last chapter, students were given a blank flow chart graphic organizer. The class was divided into two groups. Each group decided how to organize the information and complete the graphic organizer. The graphic organizers were then used by the students to study for the end-of-chapter tests.

The study concluded when students were given an identical end-of-chapter test, the graphic organizer group had a total score of 173.75 out of 200 (standard deviation = 4.33). The control group had a score of 151.25 out of 200 (standard deviation = 16.65). The students taking in the curriculum enhanced with graphic organizers scored 22 points higher than the note-taking group. These results indicate students with learning disabilities instructed with graphic organizers obtained scores that were higher than those taking traditional notes during teacher lecture. Although students with learning disabilities scored higher than those taking linear notes, there were some limitations. For example, the number of subjects in the study was small, there was no data to show student comprehension over time, and the choice of graphic organizers was subjective.

Using graphic organizers can also help students with learning disabilities attain relational knowledge from expository text. DiCecco and Gleason (2002) used graphic organizers to help students with learning disabilities identify explicit connections and relationships in expository text. Students with learning disabilities have difficulty making inferences, understanding relationships and connections, distinguishing main ideas from insignificant details, and understanding the gist of the section (DiCecco & Gleason). Even though teachers know these difficulties exist, they do not generally address comprehension skills during content learning such as in science classes.

Teachers generally assign reading, and students are then asked to respond to end of chapter questions and are then required to take an end-of-chapter test. Students with learning disabilities generally struggle with these tests. For students to retain content information, they must not only learn the facts, but how the information is connected or related to each other. This study included 26 students enrolled in two middle schools in a moderately sized city in Oregon. One school was in a low socioeconomic status area and the other in a middle socioeconomic status area. The students were chosen based on four criteria: (a) they had Learning Disabilities under the 1986 Oregon Administrative rules, (b) they were participants in special programs, (c) they had an active Individualized Education Program (IEP) in reading, and (d) they had received parent consent and their own assent to participate in the study. Both the control group and the experimental were given the same instruction. The only difference was the experimental group's use of graphic organizers implemented after reading the text. A partial graphic organizer was placed on an overhead transparency after the students read the text. The organizer focused explicitly on the relationship among the concepts in the unit being taught. The partial organizer was used to maintain student engagement and facilitate recall of information presented. The instructor demonstrated how to use the graphic organizer and then modeled how to select information placed on the organizer. After being given the information, the teacher provided a cumulative review of the information. The cumulative review served to facilitate retention of the information which would allow students to access it in the future when needed. The result of the study was that, in the no graphic organizers group, students improved their test scores from a mean of 22% correct on a pretest measure to a mean of 63% correct on the posttest measure. In the group with

graphic organizers, the students improved from 30% correct to 67% on the posttest. Both groups made progress. The most improvement was shown when students were answering essay questions. Students who were in the group with graphic organizers provided more relational knowledge statements than the group with no graphic organizers. Examples of relational statements were, "cars now made on the assembly line," or "when more products are made at one time, they are cheaper to buy." In the second essay, 11 of the 12 students in the group with graphic organizers provided three to six relational knowledge statements. In all, the students using graphic organizers included a total of 57 relational statements, with a mean of 4.75. The students not using graphic organizers included a total of 27 relational statements, with a mean of 2.75. In this study the graphic organizer provided the students the ability to access memory and respond in an organized way.

Implementing content enhancers such as graphic organizers have been studied multiple times in the last 20 years. Studies such as the one completed by Lenz et al. (1993) where a unit organizer was implemented showed it was effective when more than one graphic organizer is used during a unit of study. The unit organizer as described in the Lenz et al. study, was a graphic organizer that contained a set type of different graphic organizers that were used at different times through out the lesson. The Bulgren et al. (2002) and DiCecco et al. (1999) studies implemented only one type of graphic organizer. The Doyle (1999) study implemented three different types of graphic organizers at different points in the lesson. All four studies showed increased gains in the graphic organizer groups. Graphic Organizers provide organization of content taught that

increase the percentage correct on quizzes and test? All four studies show an increase of percentage from pre- to posttest.

## METHODS

### Setting and Participants

The participants attended a junior high where 42% of students are ethnically diverse and 60% of students receive free/reduced lunch. The school as a whole scored an average of 55% on the Utah State language arts CRT (Criterion Reference Test) test with a state goal of 71%. Students with disabilities scored an average of 19% on the Utah State language arts CRT. The students included in this study are enrolled in a general education ninth grade earth systems science classroom. The Earth Systems classroom is held on a block schedule. Students met for 90 minute periods every other day. There were approximately 32 students in the class. Currently six of those students are classified as students with learning disabilities. The students were systematically divided into a control group and an experimental group. Care was taken to balance the number of students in each group with learning disabilities, those with cultural linguistic diversity, as well as using midterm grades of students to level groups. Table 1 provides information regarding each student with learning disabilities included in the study.

### Measures

A pretest of multiple choice and essay questions was given at the beginning of the current unit. It included the concepts/content as required by the Utah State Board of Education core standards for high school Earth Systems content, with a particular focus on ecosystems and how they are shaped by interactions among other living organisms including humans (see Appendix A). The multiple choice test contained 20 questions and

Table 1

*Participants*

Students name	Grade	Ethnicity	IDEA qualification	Free/Reduced lunch	Reading level <sup>a</sup>
Joshua	9 <sup>th</sup>	Caucasian	OHI	Free	3
Carrie	9 <sup>th</sup>	Caucasian	SLD	Free	4
Rachel	9 <sup>th</sup>	Caucasian	CD	No	2
Barbara	9 <sup>th</sup>	Hispanic	SLD	Free	3
Andy	9 <sup>th</sup>	Caucasian	OHI	Free	9
Nicky	9 <sup>th</sup>	Caucasian	SLD	No	1

<sup>a</sup>The reading scores were determined, using the San Diego Quick Reading Assessment.

the essay portion of the test included two definition questions, two compare questions, and two contrast questions. A posttest was given at the conclusion of the unit taught which included the same concepts/content as the pretest. The posttest also included 20 multiple choice questions as well two definition questions, two compare questions, and two contrast questions. An analytical rubric was used to score the definition, compare, and contrast paragraphs. The rubric focused on content organization and if students use relevant content in both the topic and detail sentences (see Appendix D for the analytical rubric).

### Scoring Reliability

The experimental and control group students completed multiple choice tests were given to two teachers from another school for scoring. The scorers did not know whether



students were assigned to the experimental or the control group. An interobserver agreement index on the multiple-choice portion of the test was calculated by dividing the number of scorer agreements by the number of agreements and disagreements. The teachers scored the multiple-choice test with 100% reliability. Two educators independent of the study at another school location also scored the definition, compare and contrast essay questions using a rubric (see Appendix D) developed by the researcher and the content teacher. The reliability index was based on the scorer agreement for the points for each component of the paragraph. The scorers gave identical scores on short answer questions on all but two questions. On those two questions there was only a 1 point difference. One educator scored them higher and the other lower. The disagreement was resolved by splitting the difference between the two scorers.

#### Independent Variable

During the research project graphic organizers were used with the experimental group to present, practice, and organize content material. For example, a tree diagram was used to organize the material read in expository text as well as to compare, contrast and define the important concepts or vocabulary (see Appendix B). Students read about systems and interactions, and wrote that term as the main topic and title of the graphic organizer. Sub-topics such as, ecosystems and biomes, were in the first square at top of each column on the graphic organizers with four or five details below it. This gave the students an overview of the important content. The students were also provided an opportunity to discuss and study content included in the tree diagram graphic organizer.

In another class block, a web organizer was also implemented to help students organize vocabulary definitions. The web organizers were a tool for students to answer definition, compare, and contrast essay type questions (see Appendix C). For example, “abiotic” was on the web graphic organizer in the large circle on the diagram. The lower circles contained “temperature of climate,” “type of soil, and “area of climate.” In a definition paragraph, the topic sentence might be: “Abiotics are the non-living factors in a biome.” This was followed by three statements such as, “The non-living factors include the type of soil, area of climate, and temperature of climate in an ecosystem.” For compare and contrast short answers, the students compared two word webs. For example, in comparing niche and habitat, the students would lay the webs side by side. They could start the paragraph with: “Niche and habitat are part of a biome and have several similarities.” Then they followed it with several details on how they were alike. With contrast paragraphs, the students indicated that the two vocabulary words they were contrasting were different and they followed it with several details on how they were different.

## Research Design

### *Procedure*

On the first day of the study both the experimental group and control group were given an explanation of the research. They were then given the multiple choice pretest and the essay question pretest that includes concepts/content as required by the Utah State Board of Education core standards for high school Earth Systems. In the second half of the block the students in the control group moved to another classroom and the

experimental group remained in the classroom. Students then received instruction for seven days.

### *Experimental Group Procedure*

The experimental group received content instruction in the following sequence. In the second half of the block on the first day the experimental group was given the objectives for the unit and they previewed the content and vocabulary which includes how earth systems work with other earth systems. After previewing the concepts/content, a tree diagram graphic organizer was introduced. The students and teacher read the expository text and identified the sub-topics as well as three to four facts for each sub topic. The teacher modeled writing the sub-topics with the three to four facts written underneath. Then in small groups the students completed the tree diagram.

On day two students reviewed graphic organizers as a whole group and corrected any errors on their tree diagram. In the second half of the block students were given vocabulary words. The teacher modeled defining words using a web graphic organizer. The students worked in small groups to complete the web graphic organizers.

On the third day, students reviewed vocabulary in small groups and checked the teacher's web organizer template for completed vocabulary webs. Students used their tree diagram as a resource as they viewed several pictures and answered questions in small groups. They then joined a whole group discussion and students were shown how to use one of their vocabulary webs to answer a definition question. The teacher repeated the process and developed another definition paragraph as a group. Finally, the students worked with their vocabulary webs in small groups to answer a definition question independently.

On the fourth day in the first half of the block, the students answered a definition question using their web graphic organizer as a resource. Then each group shared their paragraph with the whole group. In the second half of the block students viewed pictures and answered questions using their tree diagram and vocabulary webs to derive a response. Students then completed the mini-lab connecting information on their tree diagram to their own neighborhood as they discovered the biome they lived in.

On the fifth day in the first half of the block the teacher taught the students how to respond to compare questions with their vocabulary webs using the same process as was employed to teach definition paragraphs. In the second half of the block students reconstructed a tree diagram from one cut into pieces.

On the sixth day the students worked in small groups and answered a compare question with a compare statement using their tree diagram and vocabulary web.

On the seventh day the students began the session by answering definition and compare questions. Next they were explicitly taught how to write an answer to a contrast question. The instructional process was the same as that used to teach students to respond to definition and compare questions.

#### *Control Group Procedure*

The control group also received seven days of instruction using the following sequence. On the first day after taking the pretest, the control group was told the objective of unit similar to the experimental group. Then, they previewed the vocabulary and content which included how earth systems work with other earth systems. The students were introduced to the outline format they used to organize information. The teacher and students read the chapter. The teacher modeled the first topic with three to

four details in traditional outline format. Finally, students completed the outline of the chapter in small groups.

On the second day the students in the control group checked their information with the teachers outline and corrected any errors. In the second half of the block the students were given the vocabulary words. Students then completed the vocabulary definitions in small groups.

On the third day the students reviewed their vocabulary words and checked definitions with the teacher's answer key. Students used their outlines as a reference while viewing several pictures and answering questions in small groups. Then, they joined a whole group discussion and students were shown how to use one of their vocabulary words and definitions to answer a definition question. The teacher repeated the process and developed another definition paragraph as a group. Finally, the students worked in small groups to answer a definition question independently.

On the fourth day the control group answered questions that lead to a definition statement using their outline in small groups. Then each group shared their definition statements with the whole group. In the second half of the block, the students viewed pictures and answered questions using their outline and vocabulary definitions to derive a response. Students then completed the mini-lab connecting information from their outline to their own neighborhood as they discovered the biome they lived in.

On the fifth day in the first half of the block, the teacher taught students how to respond to compare questions using their vocabulary definitions using the same process as employed to teach definition paragraphs. In second half of the block the students constructed an outline from one cut into pieces.

On the sixth day the students worked in small groups and developed a compare paragraph using their outline and vocabulary.

On the seventh day the students began the session by answering definition and compare questions. Next they were explicitly taught how to write an answer to a contrast question. The instructional process was the same as that used to teach students to respond to definition and compare questions.

On the eighth day the students in the experimental and control group took the multiple choice posttests. They had the first half of the block to complete the test. After a ten minute break the students took the writing portion of the test.

#### Fidelity of Implementation

To ensure that procedures were followed a script was developed and used to deliver instructions and format activities for each group. In addition, an independent observer observed instruction during two randomly selected days for each group. The observer indicated that all the prescribed activities were administered at both random checks in each group (see Appendix E for a fidelity checklist).

## RESULTS

The multiple choice data will be discussed first, followed by data from the short answer test. In addition,  $t$  tests on students' multiple choice pretests and posttests were used to compare control group scores to experimental group scores.

### Multiple Choice Pre- and Posttest Results

The data collected from the pre and post multiple-choice test are presented in a dot plot (see Figure 1). Fourteen of 15 students in the experimental group completed both the pre- and posttests as did the 14 students in the control group. All students in the experimental group showed improvement from the pre- to posttest while 86% of the students in the control group showed improvement from the pre- to posttest. The average

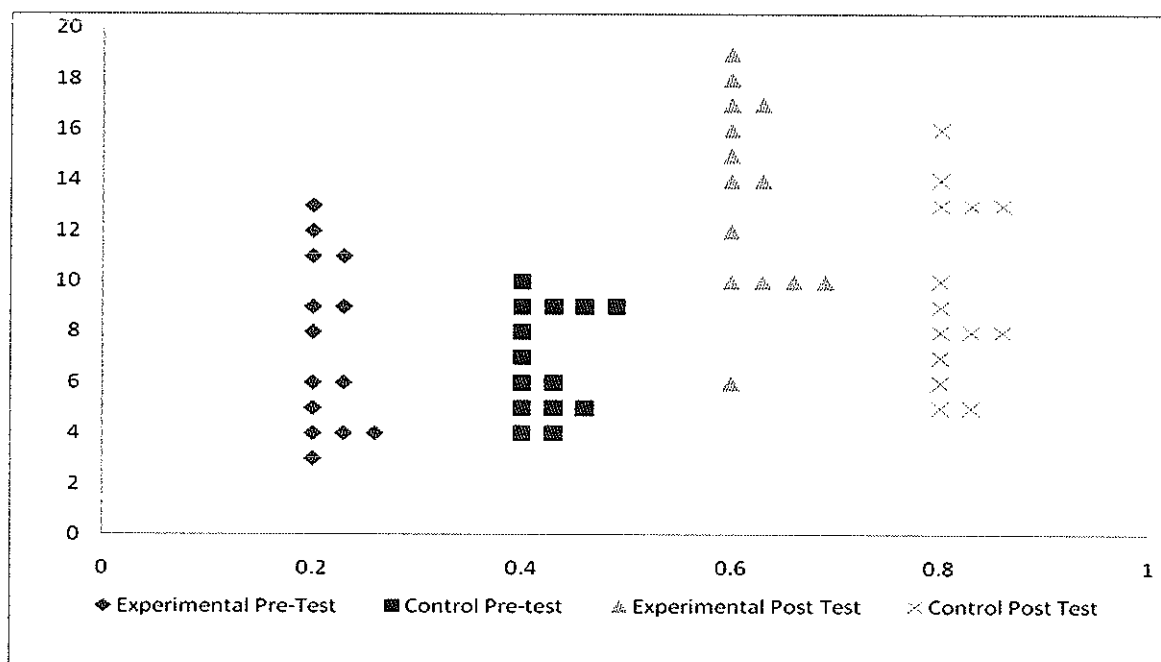


Figure 1. Multiple choice test results.

gain for students in the experimental group was 45% and the average gain for students in the control group was 30%. The pretest experimental group scores ranged from 15% to 65% and the pretest control group scores ranged from 20% to 50%. The posttest experimental group scores ranged from 30% to 95% and the posttest control group scores ranged from 25% to 80%. It is important to note that none of the students in either group scored over 65% on the pretest. There were five students in the experimental group and one student in the control group who scored 80% or higher on the multiple-choice posttest. A *t* test for independent samples revealed no statistically significant difference between group scores on the pretest ( $p \leq 0.550$ ). In contrast, the *t* test for independent samples on the posttest revealed that the experimental group's score was significantly higher than the control group's mean score ( $p \leq 0.012$ ).

#### Performance of Students with Learning Disabilities

The experimental group started with 15 students, however one student with LD stopped coming to class after the pretest portion of the research project. The performance of students with learning disabilities is provided in Table 2. One of two of the students mastered the material taught. In the control group, all three students with IEPs completed the pre and posttest. Although only one of the two students with disabilities in the experimental group mastered the material, they had an overall average gain of 45%. In contrast, the three students with disabilities in the control group had an average gain of 0%.



Table 2

*Performance of Students with Learning Disabilities on the Multiple Choice Test*

Student	Group	Pretest multiple choice	Posttest multiple choice	Gain
Nicky	Experimental	25%	50%	25%
Rachel	Experimental	20%	85%	65%
Barbara	Control	25%	30%	5%
Andy	Control	45%	65%	20%
Carrie	Control	50%	25%	-25%

## Performance of English Language Learners

Six students in the experimental group are English Language Learners. In the control group, there were six ESL students, which include Barbara who is also a student with a learning disability.

The ELL students scored a mean of a 25% improvement (see Table 3). The students who are ELL in the experimental group scored a mean gain of 20% and the control group had a mean gain of 10%. There was only one ELL student in the experimental group who scored 80% or higher on the posttest demonstrating mastery of materials. There were no ELL students in the control group mastered the material presented.

Table 3

*Performance of English Language Learners on the Multiple Choice Test*

Student	Group	Pretest multiple choice	Posttest multiple choice	Gain
Student A	Experimental	30%	90%	60%
Student E	Experimental	15%	60%	45%
Student S	Experimental	30%	50%	20%
Student P	Experimental	20%	30%	10%
Student B	Experimental	65%	70%	5%
Student J	Experimental	70%	75%	5%
Student D	Control	25%	40%	15%
Student SS	Control	20%	35%	15%
Student J	Control	30%	65%	35%
Student E	Control	20%	25%	5%
Student JJ	Control	45%	40%	-5%
Barbara ESL/SPED	Control	25%	30%	5%

## Short Answer Test Results

The distribution of students' scores for each paragraph type are presented in Figure 2 (definition paragraph scores), Figure 3 (compare paragraph scores), and Figure 4 (contrast paragraph scores). The mean pre and posttest score for each paragraph type is presented in Table 4. On the definition and contrast paragraphs, the average gain for the control group was greater than the average gain for the experimental group. Thirteen of 14 students in the control group showed improvement from the pre to posttest over the

three question types. There were no statistically significant differences between the control group and experimental group scores on any of the posttest paragraphs.

#### Paragraph Type

Overall, the control group included more students with posttest paragraph scores of 70% or higher than the experimental group. On the definition short answer questions, nine students in the control group scored 70% or higher and three students in the experimental group scored 70% or higher. On the compare short answer questions, there were no students who scored at 70% or higher in the experimental group or the control group. On the contrast short answer questions, no students in the experimental group scored 70% or higher and in the control group one student scored 70% or higher. This demonstrates that, in this study, the web organizer may have not been the better type of organizer for teaching students how to respond to definition, compare and contrast short answer questions. Importantly, while students short answers improved from pre to posttests, few students in either group developed short answer paragraphs that demonstrated content mastery.

#### *Performance of Students with Learning Disabilities*

The criterion for the short answer test was to answer a definition, compare, or contrast questions by stating the topic and then included several details. In the experimental group two of three students with IEPs (Individual Education Plan) completed the pre and post short answer test. In the control group, all three students with



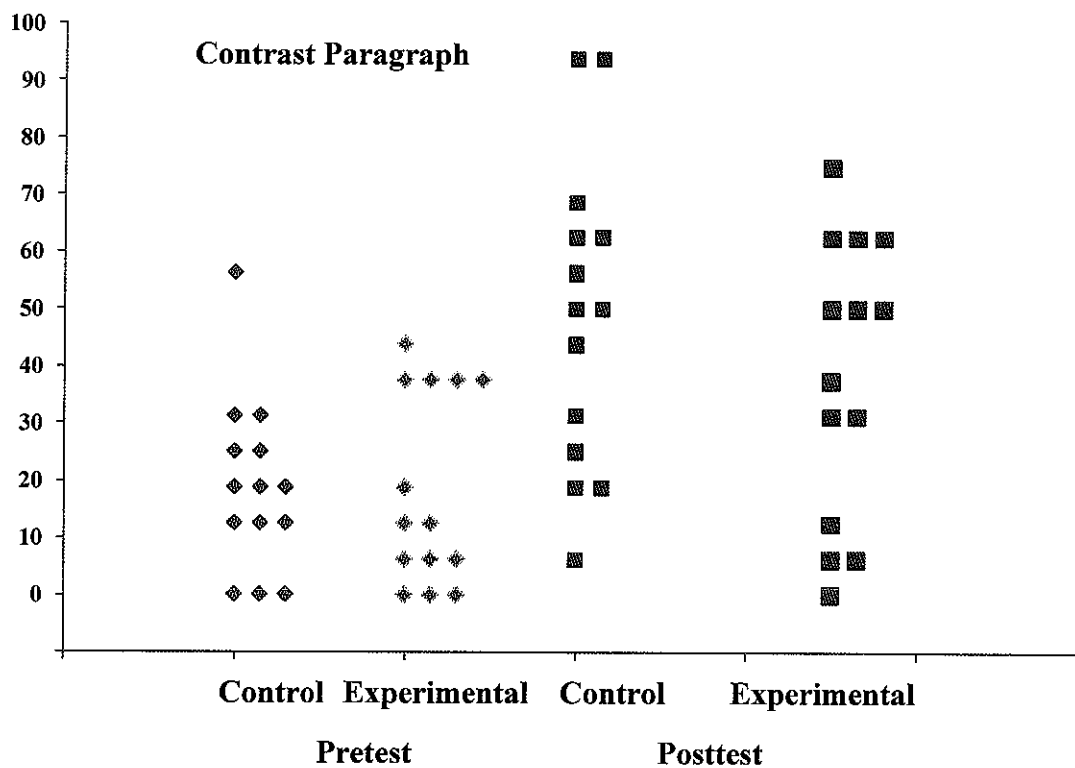


Figure 4. Short answer contrast results.

Table 4

*Experimental Group and Control Group Mean Short Answer Scores and Gain on Each*

Group	Def pre-test	Def post-test	Gain	Com pre-test	Com post-test	Gain	Con pre-test	Con post-Test	Gain
Experimental	25%	50%	25%	13%	30%	17%	18%	36%	18%
Control	30%	70%	40%	18%	31%	13%	19%	49%	30%

IEPs completed the pre and posttest. Two of the three control students with learning disabilities attended every session and one student was absent one day.

Based on the analysis of the short answer question results for students with disabilities, both the control group and the experimental group students made progress on the three types of questions (see Table 5). In the experimental group, Nicky made gains on the definition and compare questions. Rachel made gains on the definition and contrast questions. In the control group, Barbara made gains on all three question types. Andy made gains on the compare and contrast questions. Carrie made gains on the definition question only.

#### *Performance of English Language Learners*

Six students in the experimental group are English Language Learners. In the control group, there were six ESL students, which included Barbara who is also a student with a learning disability.

Based on an analysis for the results for the ELL students, both the experimental and control groups made progress on the definition, compare and contrast question types (see Table 6). Overall, ELL students in the control group who used a traditional word and definition approach produced more academic gain than ELL students in the experimental group who used a web organizer for word and definition. Students who are ELL in the experimental group had a mean gain on the definition paragraph of 4% and the control group had a mean gain of 15%. On the compare paragraph ELL students in the experimental group had a mean gain of 2% and students in the control group had a mean gain of 10%. Finally on the contrast paragraph, ELL students in the experimental

group had a mean gain of 8% and ELL students in the control group had a mean gain of 25%.

Implementing graphic organizers such as a tree diagram, does help students organize and retain information, especially when students are evaluated using a multiple choice assessment. In addition, the descriptive data suggests that these graphic organizers were useful for students with learning disabilities as well as those students who are English language learners particularly when taking multiple-choice tests. In both the control group and the experimental group 22 of 28 students scored 50% or less on the multiple choice pretest indicating that they had little knowledge of Interaction of Earth Systems. On the multiple-choice posttest more students in the experimental group than in the control group scored above 80%. One experimental student was an ELL student with a score of 90% and one student, who had an IEP, scored 85%.

Overall, on the short answer definition questions pretest 23 of 28 students scored 50% or less. On the compare questions 27 of 28 students scored 50% or less. On the contrast questions 26 of 28 students scored 50% or less. This demonstrated that the majority of students in both the experimental and control groups had little or no knowledge of answering definition, compare, and contrast questions. On the posttest short answer definition questions, more students in the control group scored 70% or greater than students in the experimental group. No students in either group scored 70% or higher on the compare questions and only one student scored 70% or higher on the contrast questions. Thus, for most students neither the web organizer nor the traditional study approach was generally effective teaching students to use the content they learned to answer definition, compare or contrast questions.

Table 5

*Students with IEPs in Experimental/Control Group's Scores on Pre- and Posttests by Question Type*

Student with IEP	Group	Def pre- test	Def post- Test	Gains	Com post- test	Com pre- test	Gains	Con pre- test	Con post- test	Gains
Nicky	Experimental	0%	13%	13%	0%	8%	8%	0%	0%	0%
Rachel	Experimental	0%	38%	38%	8%	8%	0%	0%	50%	50%
Barbara	Control	63%	75%	12%	17%	42%	25%	0%	19%	19%
Andy	Control	38%	38%	0%	25%	33%	8%	31%	63%	32%
Carrie	Control	25%	38%	13%	17%	8%	-9%	19%	19%	0%



Table 6

*ELL Students in Experimental/Control Group's Scores on Pre- and Posttests by Question Type*

ELL Student	Group	Def pre-test	Def post-test	Gains	Com pre-test	Com post-test	Gains	Con pre-test	Con post-test	Gains
Student A	Experimental	38%	25%	-13%	33%	58%	25%	38%	50%	12%
Student E	Experimental	0%	0%	0%	0%	17%	17%	6%	31%	25%
Student S	Experimental	13%	25%	12%	17%	17%	0%	38%	13%	-25%
Student P	Experimental	13%	0%	-13%	17%	8%	-9%	6%	6%	0%
Student J	Experimental	63%	100%	38%	25%	33%	8%	0%	63%	63%
Student B	Experimental	0%	0%	0%	8%	17%	8%	19%	6%	-13%
Student D	Control	13%	0%	-13%	17%	17%	0%	0%	13%	13%
Student S	Control	75%	75%	0%	0%	33%	33%	0%	25%	25%
Student J	Control	38%	75%	37%	0%	33%	33%	0%	25%	25%
Student E	Control	38%	75%	37%	33%	8%	-25%	31%	69%	38%
Student JJ	Control	13%	63%	50%	8%	33%	25%	13%	6%	7%
Barbara (SPED also)	Control	63%	75%	13%	17%	42%	25%	0%	19%	19%

## DISCUSSION

Bulgren (2006) stated: "The teacher acts as a mediator of instruction, builds on students prior knowledge, selects the most important content information, and organizes and transforms that information so that all students can succeed" (p. 55). In this study graphic organizers were the organizational tool.

On the multiple-choice test the students with learning disabilities all scored higher on the posttest than the control group. This shows that graphic organizers do help students increase their academic gain. However, not all students met mastery. More research is needed to investigate what additional strategies are required to help students not only make academic gain but master the material. In contrast, on the short answer test students in the control group outperformed students in the experimental group. Regardless of instruction, most students made some gain on the short answer test. This leads to the conclusion that, at least in this study, the web organizer was not a more effective strategy for demonstrating knowledge on short answer questions than the words with written definition approach. There are also several other factors that could have affected the student's scores. During instructional time all students in the experimental group completed the tree diagram and the vocabulary webs with the exception of two students. Student P and student A chose not to complete the assignments which most likely affected their test scores, because the assignments were the only preparation for the posttest. Student P also missed 25% of the instruction and Student A missed 12.5% of the instruction due to absence. The attendance of some other students also could have affected their scores. Three students in the experimental group missed 50% of instruction. They scored 50% or less on the posttest. There was also an issue of students

being on task. More students in the control group stayed on task, whereas the experimental group had to be reminded multiple times to continue with their group work. This suggests that a more powerful reinforcement system might need to be added to the intervention to strengthen the intervention effects. Finally, another factor that may have affected the overall performance of students in both groups was that the study took place the last five weeks of the school year. This could have been a factor because as students were completing activities some mentioned that this was the last thing they had to do before they were promoted. Others stated that it didn't matter what grade they received during the study because they would be moving to high school anyway. It is also possible that the web graphic organizer may have not been a successful tool to use in learning vocabulary or it was not utilized long enough period time for students to understand and use the information.

Multiple studies such as Lenz et al. (1993), Bulgren et al. (2002), and Doyle (1999) have shown that students do make gain when using graphic organizers. Even in these studies not all students meet mastery of content they are learning. In the Bulgren et al. study the students with learning disabilities scored a mean percentage 50.68 on the pretest and 71.2 on posttest. With mastery being 80% or better, they did not reach mastery. It did show that the graphic organizer improved learning and test scores. In the Doyle study the students with learning disabilities scored higher in the graphic organizer group than the linear note-taking group but still did not meet mastery. In the DiCecco and Gleason (2002) study the students in the graphic organizer group scored 30% on their pretest and 67% on their posttest. This was 4% higher than the control group. Still mastery of material was not met. The Lenz et al. (1993) study was implemented over a

7- month period and the majority of students' with disabilities did meet mastery. The study also showed that teachers who utilized graphic organizers prepared better and the students who used the organizers regularly increase scores by 15%. In conclusion, students with learning disabilities and ELL students using graphic organizers with multiple choice questions made more gains than the students using a traditional outline. However, only three students mastered the given material. There was one student with a learning disability and two ELL students that mastered the material. Robinson (1998) stated, "Advance Organizers help learners see the relationships among key concepts, terms, concept illustrations, and details" (p. 87). Students consistently made gains in this study as well as those reviewed. However, if reaching mastery is the ultimate goal, are graphic organizers enough or is it the amount of time the organizers are used that make the difference. In the Lenz et al. study the majority of students did meet mastery so it stands to reason that graphic organizer used on a regular basis provide students a means to meet mastery. The other studies were done on a shorter time scale and students with learning disabilities did not meet mastery.

In the DiCecco and Gleason (2002) study graphic organizers were used to help students with learning disabilities identify explicit connections and relationships in the expository text. In this study, the most improvement was shown when students answered essay questions. In the experimental group the mean gain was 4.75% in the control group the mean gain was 2.75.

Graphic organizers do provide more access to the curriculum, but in order for students to reach mastery, students may need to use them on a regular basis over longer

periods of time. Future research should be completed using graphic organizers for longer lengths of time as the Lenz et al. study had the majority of students reaching benchmark.

## REFERENCES

- Baker, S., Gersten, R., & Scanlon, D. (2002). Procedural facilitators and cognitive strategies: Tools for unraveling the mysteries of comprehension and the writing process, and for providing meaningful access to the general curriculum. *Learning Disabilities Research & Practice, 17*(1), 65-77.
- Baxendell, B. W. (2003). Consistent, coherent, creative: The 3 C's of graphic organizers. *Teaching Exceptional Children, 35*(3), 46-53.
- Boudah, D. J., Lenz, B. K., Bulgren, J. A., Schumaker, J., & Deshler, D. D. (2000). Don't water down! Enhance content learning through the unit organizer routine. *Teaching Exceptional Children, 35*(3), 48-56.
- Bulgren, J. A. (2006). Integrated content enhancement routines, responding to the needs of adolescents with disabilities in rigorous inclusive secondary content classes. *Teaching Exceptional Children, 38*(6), 54-58.
- Bulgren, J. A., Lenz, B. K., Schumaker, J. B., Deshler, D. D., & Marquis, J. G. (2002). The use and effectiveness of a comparison routine in diverse secondary content classroom. *Journal of Educational Psychology, 94*(2), 356-370.
- Chang, K., Sung, V., & Chen, I. (2002). The effect of concept mapping to enhance text comprehension and summarization. *Journal of Experimental Education, 71*(1), 12-29.
- Deshler, D., Schumaker, J., Bulgren, J., Lenz, K., Jantzen, J., Adams, G., et al. (2001). Making learning easier: Connecting new knowledge to things students already know. *Teaching Exceptional Children, 35*(4), 82-85.

- DiCecco, M., & Gleason, M. M. (2002). Using graphic organizers to attain relational knowledge from expository text. *Journal of Learning Disabilities, 35*(2) 306-320.
- Doyle, C. S. (1999). *The use of graphic organizers to improve comprehension of learning disabled students in social studies*. Dissertation/thesis.
- Dye, G. A. (2000). Graphic organizers to the rescue! Helping students link—and remember—information. *Teaching Exceptional Children, 32*(3), 72-76.
- Erickson, R., Ysseldyke, J. E., Thurlow, M. L., & Elliott, J. (1998). Inclusive assessments and accountability systems: Tools of the trade in educational reform. *Teaching Exceptional Children, 31*(2), 4-9.
- Grossen, B. (1991). The fundamental skills of higher order thinking. *Journal of Learning Disabilities, 24*(6), 343-353.
- Kim, A., Vaughn, S., Wanzek, J., & Wei, S. (2004). Graphic organizers and their effects on the reading comprehension of students with LD: A synthesis of research. *Journal of Learning Disabilities, 37*(2), 105-118.
- Lenz, B. K., Marrs, R. W., Schumaker, J. B., & Deshler, D. D. (1993). *The lesson organizer routine*. Lawrence KS. Edge Enterprises.
- Miller, T. L., & Lignaugaris-Kraft, B. (2002). The effects of text structure discrimination training on the writing performance of students with learning disabilities. *Journal of Behavioral Education, 11*(4), 203-230.
- National Center on Accessing the General Curriculum. (2003). Graphic organizers and implications for universal design for learning: Curriculum Enhancement Report, 1-27.

- National Joint Committee on Learning Disabilities. (2005). Responsiveness to intervention and learning disabilities. *Learning Disabilities Quarterly*, 28(fall), 249-260.
- Robinson, D. H. (1998). Graphic organizer as aids to text learning, Reading. *Resource and Instruction*, 37, 85-108.
- Robinson, D. H., Katayama, A. D., Dubois, N. F., & Devaney, T. (1998). Interactive effects of graphic organizers and delayed review on concept application. *The Journal of Experiment Education*, 67(1), 17-31.



## APPENDICES

## Appendix A

### Lesson Plan for Ecosystems Unit

## Lesson Plan Ecosystems Unit

**Standard I:** Ecosystems are shaped by interactions among living organisms and their physical environment. Ecosystems change constantly, either staying in a state of dynamic balance or shifting to a new state of balance. Matter cycle in ecosystems and energy flows from outside sources through the systems. Humans are part of ecosystems and can deliberately or inadvertently alter and ecosystem.

**Lesson Objective:** Students will organize information regarding ecosystems through the use of graphic organizers. They will demonstrate understanding of material by answering multiple choice questions and define, compare and contrast information about ecosystems.

**Vocabulary Words:** predator-prey, symbiosis, competition, ecosystem, carbon cycle, nitrogen cycle, oxygen cycle, population, diversity, energy pyramid, consumers, producers, limited factor, decomposers, food chain, biotic, abiotic, community, variable, evidence, inference, quantitative, qualitative.

**Materials Needed:** Pre and posttests, overhead projector, templates of graphic organizers, overhead markers, copies of graphic organizers for students. Science text books,

**Basic Lesson Structure:** Review previous learned material, introduce new material, practice in small group setting, provide independent practice, and review new material learned,

### Day 1:

#### First half of block schedule

- Students will be given explanation of research project
- Give all students multiply choice pretest and collect. Students will also be given 3-5 definition, compare, and contrast questions to complete. After completion, teacher will collect.

#### Second half of block schedule

- Introduce vocabulary and preview information from chapter 13 in expository text.
- After students preview chapter 13, the tree diagram graphic organizer will be introduced.
- Students and teacher will read text and look for three to four facts that fit under each sub topic.
- Teacher will model on an overhead transparency by completing the main topic and sub topics in the first column. Then in small group students will complete the tree diagram using a pencil (pencils will be provided) in case there needs to be changes when student group work is reviewed.

**Day 2:****First half of block schedule**

- Students will complete any unfinished information on tree diagram. Then students will review tree diagram with researcher and correct any errors and discuss information.

**Second half of block schedule**

- Students will be given the vocabulary words. The vocabulary words will be organized in words to define, compare and contrast.
- The students will use a basic web graphic organizer to define, compare and contrast identified vocabulary.
- The researcher will introduce graphic organize, link it to text, and guide students in completing one-two webs. Students will work in small groups to complete two-five vocabulary webs. Then they will work independently to complete.

**Day 3:****45 Minute class period**

- Students will review vocabulary in cooperative groups
- Review graphic organizer and compare to teachers template for correct information.
- Using their tree diagram as a resource students will view several pictures and discuss the following questions:
  1. What needs do all of the living things in these photos?
  2. What types of animals are shown in picture b?
  3. What kind of environmental changes might be affecting the coral and the gorilla?
  4. What has happened to the trees in photograph c? What could have caused this?
- This discussion will lead into writing text structures that define. Researcher will take one of the graphic organizer webs such prey and will explicitly teach students to answer a question that defines. First writing a topic sentence and then adding two-three descriptive sentences and finally a summary sentence. Then have student follow process with another web in small group. Then have groups share.

**Day 4****First half of block schedule**

- Students will answer a question that needs to be answered as a definition text structure as a cooperative group using their graphic organizers as a resource. Then each group will present answer to the whole group.
- Students will individually be given an expository definition question and answer it using the process used in previous days lesson and small group work. Check for accuracy. Reteach skill if necessary.

### **Second half of block schedule**

- View photographs and answer the following questions in whole group. Have student refer to Tree diagram
  1. Which of the organisms shown in these photographs must eat other organisms to obtain food?
  2. What do swans eat?
  3. What do seals eat?
  4. Which organisms in the photographs do not eat other organisms?
- In small groups students will do following activity.  
 Mini Lab: Life in your neighborhood. Classifying organisms in students' neighborhoods.  
 Students answer the following questions:
  1. Choose an area around your school or around your home. Make a list of the different organisms—such as plants, insects, animals, and people—that you see.
  2. Classify each organism as either a primary producer or consumer.
  3. Further classify each consumer as a carnivore or herbivore.
 Analyze and Conclude
  1. What organisms did you classify as primary producers? Consumers?
  2. Did you observe any herbivores? What were they?
  3. Did you observe any carnivores? If so, what were they?
  4. What do you think would happen if all the primary producers in the area dried out?

### **Day 5**

#### **First half of block schedule**

- Students will review mini-lab activity and discuss commonality and differences in the organisms/animals in their community.
- Researcher will write compare question on the board. Next the student will be explicitly taught using a previously completed web with vocabulary words that answers the compare question. Researcher will use previous completed web to create topic sentence, two-three detail sentences and a summary sentence.

#### **Second half of block schedule**

- Students will sort Tree diagram using a provided cut up organizer. Students will compare with overhead of Tree diagram.

### **Day 6**

#### **45 Minute class period**

- Students in small groups will answer variety of compare questions and then share with whole group.
- Students will answer a compare question as an individual. Will be ticket out of class. Review and reteach skill in next class period if necessary.

**Day 7****First half of block schedule**

- Students will complete a self-start of answering a definition and compare questions. They can use webs created in earlier lessons.
- Researcher will take one of the graphic organizer webs such herbivores and will explicitly teach students to answer a question that contrasts. A contrast question will be written on the board. First writing a topic sentence and then adding two-three descriptive sentences and finally a summary sentence. Then have student follow process with another web in small group. Then have groups share.

**Second half of block schedule**

- The researcher will review information from the chapter through a carousel activity. Vocabulary will be written on charts around the room. Students in small groups will write everything they know about the word. Each group will be given a different color marker.

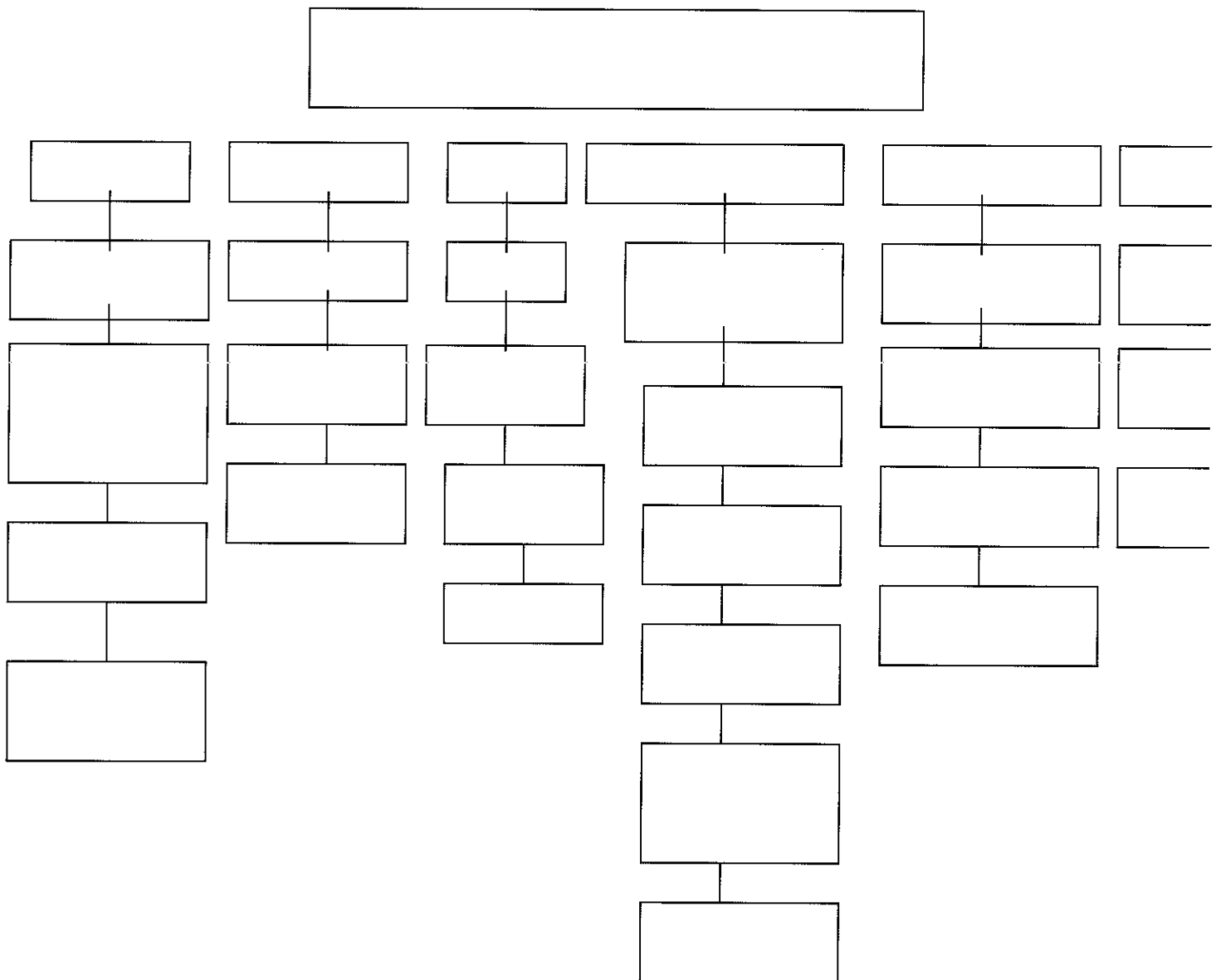
**Day 8**

- Both the control group and experimental groups are given the unit posttest.
- Students will take a 10 minute break.
- Both groups will take text definition, compare, and contrast question posttest.

Appendix B  
Tree Diagram for Earth Systems

## Tree Diagram

### Earth Systems



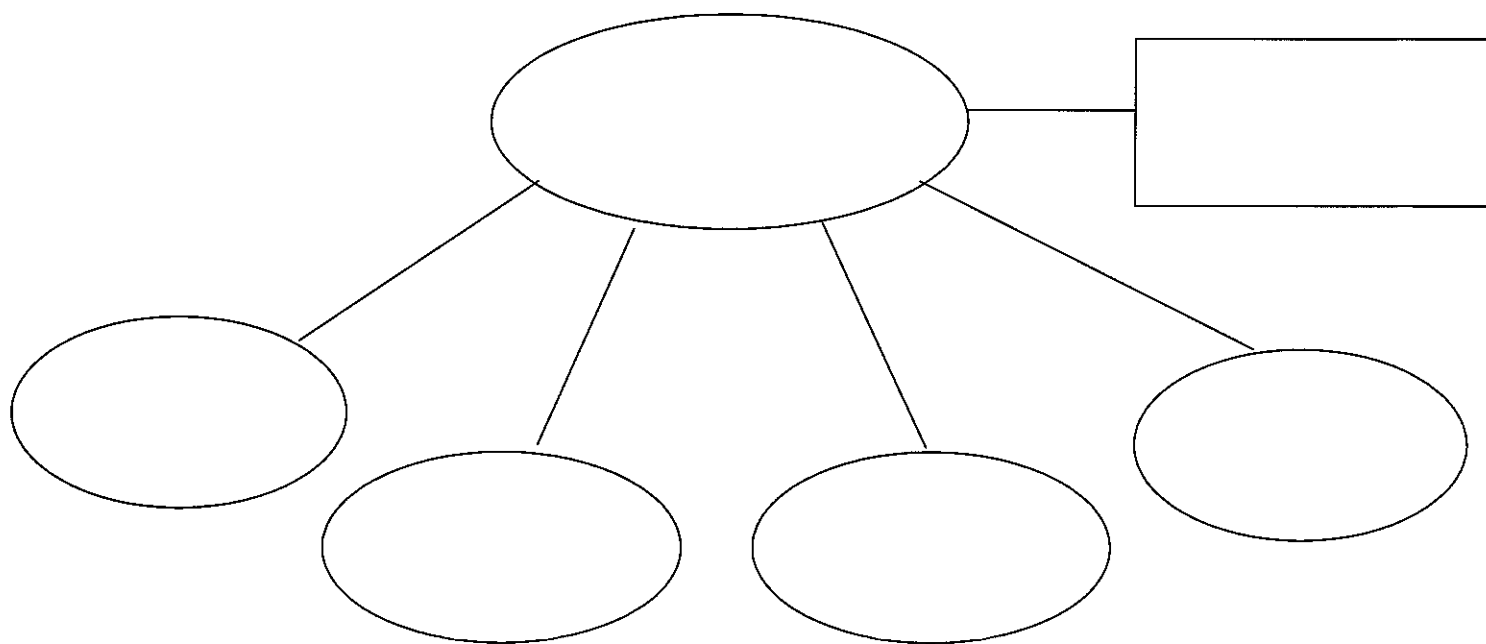
\*Under each sub topic will be three to five important facts/information about the sub topic.



## Appendix C

### WEB Organizer for Short Answer Questions

## WEB Organizer for short answer questions



## Appendix D

### Rubric

### Rubric

#### Definition Paragraph (used to define)

Score	Criteria	Comments
	Does the opening sentence/phrase/comment place the vocabulary in a larger category or group or common class- a producer is part of an eco-system.	
	Described all the unique details related to the vocabulary.	

0-for none; 1-put in category or provided synonym but the category/synonym is not relevant or incorrect; 2-put in relevant category or synonym

0-no relevant details; 1-one detail provided but incorrect; 2- correct detail provided.  
(Score each detail sentence/phrase/comment with this rating)

#### Compare Paragraph (similarities between two biology terms)

Score	Criteria	Comments
	Does the opening sentence/phrase/comment indicate that two topics have similarities?	
	Is the detail relevant to vocabulary/content that is being compared? Are key words being used like both, same way, or similar	

0-for none; 1-describes the two biology terms that are similar but not correctly; 2-describes two biology terms that are similar correctly.

0-for none; -one similarity with key words provided but incorrect; 2-correct similarity with key words provided. (Score each detail sentence/phrase/comment with this rating)

#### Contrast Paragraph (differences between biology terms)

Score	Criteria	Comments
	Does the opening sentence/phrase/comment indicate that two topics have differences	
	Is the detail relevant to vocabulary/content to show difference? Are key words being used like but, in contrast, however, or on the other hand.	

0-for none; 1-describes the two biology terms that are different but not correctly; 2-describes two biology terms that are different correctly.

0-for none; -one difference with key words provided but incorrect; 2-correct difference with key words provided. (Score each detail sentence/phrase/comment with this rating)

## Appendix E

### Fidelity Checklist (Experimental group)

**Fidelity Checklist**  
**(Experimental group)**

<b>Day</b>	<b>Activity</b>	<b>Yes</b>	<b>No</b>
<b>1a</b>	Students will take multiple choice test and short answer biology questions (pretest)		
<b>1b</b>	Students will preview content and vocabulary which includes how ecosystems work with organisms including humans.		
<b>1c</b>	Students will be introduced to Tree Diagram. Teacher and students will read expository text and identify sub-topics with three to four facts/details		
<b>1d</b>	Teacher will model the placement of sub-topics and facts/details. Sub-topic in top box with details written underneath. Students will complete their Tree Diagram in small groups		
<b>2a</b>	Students will review their Tree Diagram in whole group discussion. Students will correct any errors		
<b>2b</b>	Students are given vocabulary/biology terms. Teacher models completing a word web for each vocabulary/biology term. Students will then complete word webs in small group.		
<b>3a</b>	Students will review their vocabulary webs in small groups and check teacher's templates for complete webs. The students will correct any errors		
<b>3b</b>	Using Tree Diagram as a resource, students will view pictures and answer questions in small groups.		
<b>3c</b>	Students will join whole group discussion and teacher will show students how to answer definition questions using their web.		
<b>3d</b>	The teacher will repeat process and develop another definition paragraph as a whole group.		
<b>3e</b>	Students will then work in small groups to complete a definition paragraph independently.		
<b>4a</b>	Students will answer a definition question using web as resource and write definition paragraph independently and share whole group.		
<b>4b</b>	Students will view pictures using their Tree Diagram and vocabulary webs as resources to derive answers.		
<b>4c</b>	Students will complete mini-lab connecting information from their Tree Diagram to their own neighborhood.		

**Fidelity Checklist**  
**(Experimental group)**

<b>Day</b>	<b>Activity</b>	<b>Yes</b>	<b>no</b>
<b>5a</b>	Teacher will teach students how to respond to compare questions using vocabulary words. Teacher will use same process as employed in definition paragraphs.		
<b>5b</b>	Students will reconstruct a Tree Diagram from one cut into pieces.		
<b>6a</b>	Given compare questions students will work in small groups to develop compare paragraphs using their Tree Diagrams and vocabulary webs.		
<b>7a</b>	Students will have a self start of writing definition and compare paragraphs.		
<b>7b</b>	Teacher will teach students how to answer contrast question using the same process as definition and compare questions.		
<b>8a</b>	Students will take multiple choice test and short answer biology questions (posttest)		

**Fidelity Checklist  
(Control group)**

<b>Day</b>	<b>Activity</b>	<b>Yes</b>	<b>No</b>
<b>1a</b>	Students will take multiple choice test and short answer biology questions (pretest)		
<b>1b</b>	Students will preview content and vocabulary which includes how ecosystems work with organisms including humans.		
<b>1c</b>	Students will be shown a traditional outline. Teacher and students will read expository text and identify sub-topics with three to four facts/details		
<b>1d</b>	Teacher will model the placement of sub-topics and facts/details in the outline format. Sub-topic on top line with details written underneath. Students will complete outline in small groups		
<b>2a</b>	Students will review their outlines in whole group discussion. Students will correct any errors		
<b>2b</b>	Students are given vocabulary/biology terms. Students will define vocabulary/biology term in traditional way. Students will then complete their vocabulary in small group.		
<b>3a</b>	Students will review vocabulary in small groups and check teacher's definitions. They will correct any errors		
<b>3b</b>	Using their outline as a resource, students will view pictures and answer questions in small groups.		
<b>3c</b>	Students will join a whole group discussion and teacher will show students how to answer definition questions using their vocabulary and biology terms as a resource..		
<b>3d</b>	The teacher will repeat process and develop another definition paragraph as a whole group.		
<b>3e</b>	Students will then work in small groups to complete a definition paragraph independently.		
<b>4a</b>	Students will answer a definition question using definitions as resource and write definition paragraph independently and share whole group.		
<b>4b</b>	Students will view pictures using their outlines and vocabulary webs as resources to derive answers.		
<b>4c</b>	Students will complete mini-lab connecting information from outline to their own neighborhood.		



**Fidelity Checklist  
(Control group)**

<b>Day</b>	<b>Activity</b>	<b>Yes</b>	<b>no</b>
<b>5a</b>	Teacher will teach students how to respond to compare questions using vocabulary words. Teacher will use same process as employed in definition paragraphs.		
<b>5b</b>	Students will reconstruct outline from one cut into pieces.		
<b>6a</b>	Given compare questions students will work in small groups to develop compare paragraphs using their outlines and vocabulary/biology term definitions.		
<b>7a</b>	Students will have a self start of writing definition and compare paragraphs.		
<b>7b</b>	The teacher will teach students how to answer contrast question using the same process as definition and compare questions.		
<b>8a</b>	Students will take multiple choice test and short answer biology questions (posttest)		